

Apparatus for connection to private circuits run by certain public telecommunication operators —

Part 1: Specification for apparatus for connection to speechband circuits

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Telecommunications Standards Committee (TCL/-) to Technical Committee TCL/5 upon which the following bodies were represented:

- Association of Telecommunications Services
- British Airways
- British Approvals Board for Telecommunications
- British Gas Corporation
- British Security Industry Association
- British Telecommunications
- Business Equipment Trade Association
- Cable and Wireless plc
- Committee of London Clearing Bankers on behalf of London and Scottish Clearing Banks and Yorkshire Bank
- Department of Trade and Industry, Telecommunications Division
- Electricity Supply Industry in England and Wales
- Electronic Engineering Association
- Engineering Equipment and Materials Users' Association
- Independent Broadcasting Authority
- Mobile Radio Users' Association
- OFTEL (Office of Telecommunications)
- Post Office Engineering Union
- Society of Telecom Executives
- Telecommunication Engineering and Manufacturing Association (TEMA)
- Telecommunications Managers Association
- Telecommunications Users Association (TUA)
- UK Offshore Operators' Association Ltd.

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Foreword

This Part of BS 6328 has been prepared under the direction of the Telecommunications Standards Committee. It forms one of a series of British Standards that is being produced following the commencement of liberalization in October 1981 of the supply of certain telecommunications apparatus within the United Kingdom. This standard has been revised to provide additional technical requirements to make it suitable for designation under the Telecommunications Act 1984. It supersedes BS 6328-1:1982, which is withdrawn.

This series of standards will include product specifications giving particular requirements for individual items of apparatus, together with standards covering general requirements for the connection of apparatus to various public telecommunication systems (i.e. any telecommunication system designated as a public telecommunication system by an order made under Section 9 of the Telecommunications Act 1984). At the present time, these systems include the public switched telephone networks, the telex networks, the packet switching services, and leased private circuits run by British Telecommunications plc and Kingston-upon-Hull City Council.

The requirements specified in the standards also apply to certain forms of "indirect" connection of apparatus to public telecommunications systems. Because of the wording of Section 4(6) of the Telecommunications Act 1984, "indirect" connection is referred to in these standards as connection to a relevant branch telecommunication system which is not itself a public telecommunication system, but is connected to one or more such systems.

The requirements specified in the standards are intended to ensure that apparatus complying with them, when connected to public or branch telecommunication systems, will neither adversely affect any public system nor interfere with the service available to other users of public telecommunication systems. The standards include safety requirements only for the protection of personnel operating the public telecommunication system and for the protection of users from hazards that may arise from the connection of the apparatus, directly or indirectly, to such a system.

Private circuits run by British Telecommunications plc or Kingston-upon-Hull City Council are classified into the following groups:

- a) speechband circuits;
- b) baseband circuits;
- c) direct current circuits;
- d) telegraph circuits using SCVF signalling;
- e) wideband (FDM) circuits;
- f) programme circuits;
- g) digital circuits.

This Part of BS 6328 deals with speechband circuits. Other Parts of this standard cover apparatus for connection to other private circuits.

Some general information on British Telecommunications plc's speechband circuits is given in Appendix A. This information is also generally applicable to private circuits run by Kingston-upon-Hull City Council.

This standard has been presented for designation under Section 22(6) of the Telecommunications Act 1984. It is stipulated in that Section of the Act that apparatus within the scope of a designated standard may only be approved for connection to a telecommunication system if it complies with that standard, subject to such exceptions as may be determined by or under the designation. While special arrangements apply to the approval of “one-off” items of apparatus, type-approval for direct or “indirect” connection (see the third paragraph) to public telecommunication systems run by British Telecommunications plc or Kingston-upon-Hull City Council may only be given by the Secretary of State, the British Approvals Board for Telecommunications (BABT) or British Telecommunications plc. The Director General of Telecommunications may also be authorized to grant approval, but neither he nor the Secretary of State will normally entertain applications for approval of apparatus. Such applications should be addressed in the first instance to the Director, British Approvals Board for Telecommunications, Mark House, The Green, 9-11 Queen’s Road, Hersham, Walton-on-Thames, Surrey, KT12 5NA.

The designation of this standard may stipulate variations of, or additions to, the requirements of this standard and may also set conditions that have to be complied with as regards to apparatus or its connection or use. A copy of the designation will be included, when available, with all copies of this standard. Any further information on, or details of, the designation of this standard may be obtained from the Office of Telecommunications (OFTEL), Atlantic House, Holborn Viaduct, London EC1N 2HQ.

Some apparatus may incorporate facilities for which a mandatory standard is necessary, but for which no standard has yet been designated under the Telecommunications Act 1984. Other apparatus may incorporate innovative features not foreseen when the relevant standard was written and designated and for which that standard is not fully appropriate. The BABT can sometimes deal with these cases by writing a “Special investigation test schedule” (SITS), which has the effect of stating requirements where there is no designated standard or of supplementing or varying the requirements in the application of the designated standard. Information on any relevant SITS may be obtained from the Director, BABT.

If this course is not possible, British Telecommunications plc may nevertheless type-approve apparatus for connection to its public telecommunication systems or those run by Kingston-upon-Hull City Council, and to branch systems connected to any of these public systems.

The requirement specified in **5.1.3** will be withdrawn after 31 December 1987, and thereafter apparatus will be tested in accordance with **5.1.2**.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 38, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 6328 specifies requirements for apparatus in household, business or office environments, including specialized test apparatus, to be connected to speechband private circuits either directly or by means of a connection to a relevant branch system for speechband circuits. This Part of BS 6328 does not apply to apparatus used to convey live speech which has been, or is to be, conveyed by means of a public switched telecommunication system except to the extent provided for in a relevant product standard.

NOTE 1 Under the "Class Licence for the Running of Branch Telecommunication Systems" granted by the Secretary of State for Trade and Industry under Section 7 of the Telecommunications Act 1984, all branch systems, including therefore relevant branch systems for speechband circuits, have to be comprised entirely of apparatus approved for that purpose. This means that wiring or other apparatus not suitable for prior approval, has to be installed in accordance with a relevant code of practice or such other requirements as may be agreed with the operator of the speechband circuits or apply under the conditions of relevant licences or approvals.

The requirements provide for the safety of the public telecommunication systems from electrical conditions originating in the connected apparatus and vice versa. The requirements are also intended both to minimize the risk of interference with other users and to minimize the risk of malfunctioning of public telecommunication operators' main transmission plant both from signals of excessive power level and signals that have frequency components which lie outside the normal frequency bands.

This Part of BS 6328 does not apply to apparatus approved under Section 16(2) of the British Telecommunications Act 1981 or Section 22 of the Telecommunications Act 1984 before this Part of BS 6328 is designated. Neither does it apply to apparatus connected to any telecommunication system for development purposes or when under test.

NOTE 2 Compliance with this Part of BS 6328 is intended to provide for safety and the absence of interference with networks and other users, but compliance will not necessarily ensure that the equipment is satisfactory for the user's purposes.

NOTE 3 Public telecommunication operators may offer speechband circuits under a different name that may change from time to time. Public telecommunication operators should specify which of their circuits are appropriate for the connection of apparatus complying with this Part of BS 6328 or any of the other Parts.

NOTE 4 The characteristics of British Telecommunications plc speechband circuits are given in Appendix A. The characteristics of Kingston-upon-Hull City Council speechband circuits are obtainable by writing to:

Kingston-upon-Hull Telephone Department
Telephone House
Carr Lane
Kingston-upon-Hull
HU1 3RE

For the attention of:
The Technical Support Unit
Transmission and Private Circuits Section
(Reference B.12)

NOTE 5 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 6328, the following definitions, together with those given in BS 4727, apply.

One of the definitions given below differs from that given in BS 4727; it is marked with an asterisk.

NOTE The relevant BS 4727 publications concerned are:

Part 1:Group 01:1983;
Part 2:Group 01:1971;
Part 3:Group 02:1971.

2.1

2-wire circuit

a circuit that is presented to the apparatus in the form of two conductors

2.2

4-wire circuit

a circuit that is presented to the apparatus in the form of four conductors. Each direction of transmission is formed by two conductors

2.3

circum-aural receiver

a receiver that engages the surface of the head to form a substantially sealed cavity enclosing the pinna, but does not allow close contact between the driver unit of the receiver and the surface of the pinna

2.4

insert receiver

a small receiver coupled to the ear canal by means of an ear insert or attached to a connecting element that is inserted into the ear canal

NOTE This ear insert may be a part of the insert receiver.

2.5

longitudinal conversion loss

a measure of the immunity of the apparatus to interference from longitudinal voltages

it is expressed in decibels as the ratio between a sinusoidal voltage applied between earth and the centre-point of a balanced connection to the output terminals of the apparatus and any resultant voltage appearing across those terminals

NOTE When the longitudinal conversion loss is large, the apparatus has a good ability to reject longitudinal signals and not reproduce them as noise.

2.6

mean receiving crosstalk sensation level

the equivalent mean sensation level ($\bar{Z}$) giving loudness equal to that of a continuous spectrum sound

2.7

pink noise

noise whose sound spectral density is inversely proportional to frequency

2.8

relevant branch system for speechband circuits

a telecommunication system, other than a public telecommunication system, that:

- a) is run under a licence granted, or having effect as if granted, under Section 7 of the Telecommunications Act 1984; and
- b) is connected to one or more speechband circuits; and
- c) is such that any apparatus to which this standard applies which forms part of it, or is connected via it, is so connected that no signals of any kind may be conveyed between that apparatus and a speechband circuit or vice versa except by means of other apparatus which does not materially affect the electrical conditions presented to one another by that apparatus and the speechband circuit.

NOTE 1 For the purposes of this definition, any apparatus is treated as connected to a speechband circuit if it is connected to a relevant branch system for speechband circuits which is itself connected to the speechband circuit or is regarded as being so connected by virtue of this provision.

NOTE 2 Unless provided otherwise in the licence referred to in a), all the apparatus comprised in or connected to a relevant branch system has to be apparatus approved for that purpose. Items such as wiring and accessories, e.g. junction boxes, that cannot be said to satisfy compatibility or safety requirements prior to installation have to be installed safely and in such a way that the criterion of item c) is met. An appropriate code of practice is under consideration. All other apparatus has to be type-approved in the usual way or be the subject of individual approval.

2.9

return loss

a quantity, expressed in decibels, associated with the degree of match between two impedances calculated from the following expression:

$$20 \log_{10} \left| \frac{Z_b + Z_t}{Z_b - Z_t} \right|$$

where

- Z_t is the measured complex impedance;
- Z_b is the reference complex impedance.

NOTE 1 The input impedance of the apparatus is measured at the terminals.

NOTE 2 Return loss is an indication of the impedance matching of the apparatus to the circuit, e.g. a large return loss represents good impedance match.

2.10

specialized test apparatus

apparatus whose sole purpose is to determine the transmission parameters of, or monitor the performance of, private or other circuits

NOTE Examples of specialized test apparatus are signal generators and group delay measuring apparatus.

2.11

spectral density

the limit, as the bandwidth approaches zero, of the mean square value of a field quantity divided by bandwidth

NOTE When the term spectral density is used, the kind of field quantity is stated, for example, as sound pressure.

2.12

speechband circuit

any speechband circuit run by British Telecommunications plc or by Kingston-upon-Hull City Council under a public telecommunication operator's licence granted under Section 7 of the Telecommunications Act 1984

NOTE Speechband circuits may be offered under other names.

2.13

supra-aural receiver

a receiver that is applied directly to the pinna of the ear

2.14

terminals*

any means associated with the apparatus for making an electrical connection to any speechband circuit or relevant branch system for speechband circuits

NOTE 1 Output or transmit terminals are those through which an electrical signal originating in the apparatus passes to a private circuit.

NOTE 2 Input or receive terminals are those through which an electrical signal from a private circuit passes into the apparatus.

2.15

transverse conversion loss

a measure of the impedance balance between the output terminals of the apparatus and earth

it is expressed in decibels as the ratio between a sinusoidal voltage applied across the output terminals and any resultant voltage appearing between the centre-point of a balanced connection to the output terminals and earth

NOTE When the transverse conversion loss is large, the apparatus is said to be balanced. A balanced apparatus has a good ability to prevent crosstalk between circuits.

3 Reference level

The reference level for all power levels expressed in dBm shall be 1 mW.

NOTE Further information on all expressions for power levels used in this Part of BS 6328 is given in CCITT Recommendation B.12 (1981).

4 General requirements

4.1 Safety requirements

Apparatus shall comply with BS 6301:1982.

If it is necessary to use apparatus with a separate protection barrier or barriers between the apparatus and a speechband circuit in order to satisfy the requirements of BS 6301, such a protection barrier or barriers shall comply with BS 6301. In addition the apparatus shall be marked as specified in clause 8 of this standard and shall be provided with the information specified in clause 9 of this standard. Compliance shall be checked by inspection.

4.2 General test requirements

NOTE The tests described in this standard are type tests as defined in BS 4778:1979.

For the purpose of the tests specified in this standard, the apparatus shall be supplied with either:

- a) 2.5 ± 0.25 m length of cable having solid copper wire conductors of nominal size between 0.4 mm and 0.6 mm diameter, or
- b) 2.5 ± 0.25 m of flexible cable connected to a plug complying with BS 6312:1982.

One end of the cable, in option a), or the alternate end to that with the plug in option b), shall be connected to the apparatus. In option a), the function and identification of the cable conductors shall be specified by the supplier. In option b), the plug connections shall be compatible with the connection arrangements for the line jack unit shown in Table 5.

Compliance shall be checked by inspection.

Apparatus approved following tests using one of these methods of connection [see items a) and b)] shall be deemed to be approved for use in accordance with any of the arrangements of clause 7.

4.3 Environment for tests

Unless otherwise specified in a particular test, the tests are made under normal operating conditions with:

- a) an ambient temperature in the range 15 °C to 25 °C;
- b) a relative humidity in the range 45 % to 75 %;
- c) an air pressure in the range 86 kPa to 106 kPa.

4.4 Test frequency range

Unless otherwise specified in this standard, the test frequency range shall be 0 Hz to 10 MHz.

4.5 Normal operating modes and non-operating states for test

Where relevant, the requirements of this Part shall be complied with in all normal operating modes of the apparatus including non-operating states [see 9.3 j)]. Tests shall be carried out in such non-operating states or combinations of normal operating modes as are appropriate to demonstrate such compliance, taking account of the operating principles of the apparatus.

NOTE Simulation of normal operating mode or non-operating states, for example by the use of terminating components, is acceptable.

4.6 Termination of output terminals for test

Unless otherwise specified in a particular test, tests shall be performed with the output terminals of the apparatus terminated either with a 600 Ω resistor, or the network shown in Figure 1.

NOTE When apparatus is submitted for test, the preferred termination should be stated.

4.7 Tolerance on components for test

Unless otherwise specified in this standard, all resistors and capacitors assigned values in this standard for the purpose of testing shall be within ± 0.5 % of their nominal value.

4.8 Tolerance on test measurements of power

Unless otherwise specified in this standard, the tolerance shall be ± 0.2 dB.

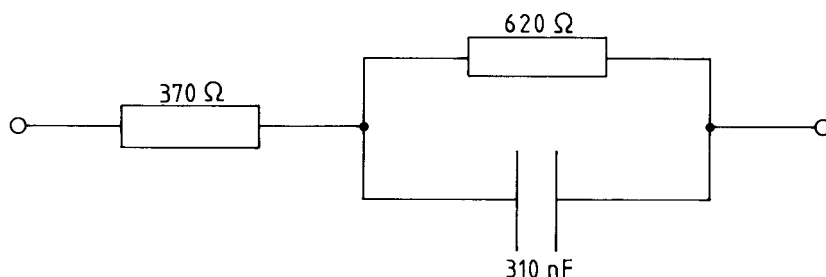
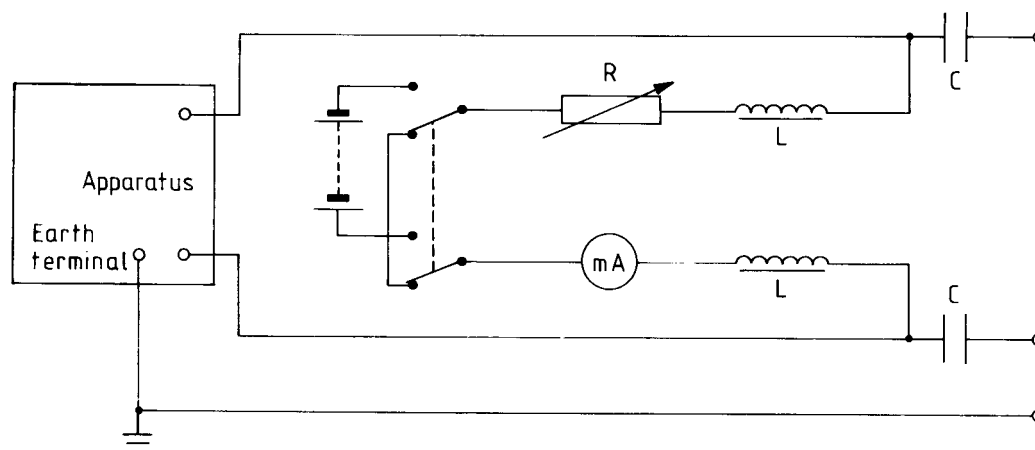
4.9 Resistors for tests

All resistors specified in this standard for testing shall be nominally non-reactive, such that any resistor or group of resistors shall have a reactive impedance at any frequency in the range to be measured, not exceeding 0.5 % of the nominal impedance.

4.10 Test requirements for apparatus in which direct currents flow (see Figure 2)

4.10.1 If the instructions for use [see 9.3 l)] state that d.c. interaction between the apparatus and a speechband circuit is possible, apparatus shall be connected to the circuit shown in Figure 2 for the tests described in Appendix B to Appendix F. The terminals at the right of Figure 2 shall then be regarded as the apparatus terminals in Figure 9 to Figure 11.

4.10.2 The values of capacitors C shall be not less than 400 μ F for measuring impedance in 5.1 or greater than or equal to 100 μ F matched to within 0.01 % for measurement of balance-about-earth in 5.3.

Figure 1 — Load Z_L for return loss measurements

NOTE If the apparatus has separate protective and signal earth terminals they are connected together.

Figure 2 — Additional circuitry for testing apparatus in which direct currents flow

4.10.3 The values of inductors L shall be not less than 10 H when a current of 120 mA is flowing through the windings.

4.10.4 The battery shall be isolated from earth.

Compliance shall be checked by measuring the transverse conversion loss as described in Appendix E with the connections to the apparatus in Figure 2 left open circuit and the battery connected. The transverse conversion loss shall be not less than 60 dB over the range of frequencies to be measured.

4.10.5 Either the variable resistor R shall be set so that the maximum direct current specified in the instructions for use flows through the milliammeter with the switch connected to battery, or the switch shall be connected to loop if the user guide indicates that this shall be done.

4.11 Application of this Part of BS 6328 to telephones

Apparatus for connection to speechband circuits, or relevant branch systems for speechband circuits, shall comply with the requirements of this Part of BS 6328, except that telephones shall comply as follows.

Telephones for direct connection to a speechband circuit shall either:

- a) comply with the relevant requirements of clauses 4 to 9 of this standard; or
- b) comply with the relevant requirements of clause 9 and be of a type that in all respects except for connections is approved for direct connection to the PSTN.

Telephones to be connected to or comprised in a relevant branch system for speechband circuits shall either:

- c) comply with the relevant requirements of clauses 4 to 9 of this standard; or

d) comply with the relevant requirements of clause 9 and be of a type that is approved for direct connection to the PSTN.

Compliance with b) or d) above shall be checked by verification of the approval status of the apparatus.

5 Electrical requirements for apparatus other than specialized test apparatus

5.1 Impedance presented to line

5.1.1 Apparatus intended for connection to 2-wire circuits shall comply with either **5.1.2** or **5.1.3**, at frequencies within the range 200 Hz to 4 000 Hz.

NOTE It is strongly recommended that all apparatus should comply with **5.1.2** since, as a result, interference with other users is minimized and the quality of performance of apparatus connected to speechband circuits is improved. The alternative requirement of **5.1.3** will be withdrawn after 31 December 1987 (see foreword). When apparatus is submitted for test, the subclause (i.e. either **5.1.2** or **5.1.3**) with which the apparatus is intended to comply should be indicated.

5.1.2 The return loss of apparatus intended for connection to 2-wire circuits shall be measured either against the load network Z_L shown in Figure 1, when it shall be not less than 12 dB or against a 600 Ω resistor in place of Z_L , when it shall be not less than 14 dB. In the latter case the impedance of the apparatus shall have an inductive component less than 50 Ω . Compliance shall be checked by the method described in Appendix B.

NOTE 1 When apparatus is submitted for test, the load to be used for the return loss measurements should be indicated.

NOTE 2 See **6.2** for the return loss requirements for specialized test apparatus.

5.1.3 The impedance of apparatus intended for connection to 2-wire circuits shall have a resistive component not less than 400 Ω and not greater than 1 000 Ω , and a reactive component not less than – 350 Ω and not greater than 350 Ω . Compliance shall be checked by the method described in Appendix B.

5.1.4 The return loss of apparatus intended for connection to 4-wire circuits shall be not less than 15 dB for each pair of wires at any frequency in the range 200 Hz to 4 000 Hz. Compliance shall be checked by applying the method described in Appendix B to each pair of wires against a 600 Ω resistor in place of Z_L .

5.2 Receive-to-transmit loss of apparatus intended for connection to 4-wire circuits

NOTE Examples of factors that would influence receive-to-transmit loss are:

- a) *transhybrid loss*, where the apparatus contains a hybrid transformer to convert the 4-wire circuit into a 2-wire circuit (here the transhybrid loss is a function of the return loss of the 2-wire circuit against the balance circuit);
- b) *acoustic coupling*, where there is acoustic coupling between transducers connected to the receive and transmit pairs.

5.2.1 Apparatus in test mode. The requirements of **5.2.2** and **5.2.3** shall not apply to apparatus when it is in a test mode such that the input terminals are electrically connected to the output terminals.

5.2.2 Point-to-point circuits. The receive-to-transmit loss of apparatus designated as suitable for use on point-to-point circuits, shall in all operational states of the apparatus and at any frequency in the range 300 Hz to 3 400 Hz, be not less than the RTL (receive-to-transmit loss) number marked on the apparatus. The RTL number shall be a positive integral value of receive-to-transmit loss measured in decibels.

Compliance shall be checked by measurement(s) of the receive-to-transmit loss by the method described in Appendix C.

5.2.3 Omnibus or multipoint circuits. The receive-to-transmit loss of apparatus designated as suitable for use on omnibus or multipoint circuits shall be at least 28 dB at any frequency in the range 300 Hz to 3 400 Hz.

Compliance shall be checked by the method described in Appendix C.

NOTE Point-to-point, omnibus and multipoint circuits are described in **A.3**.

5.3 Apparatus balance-about-earth

NOTE There is no requirement for longitudinal conversion loss. It is recommended that apparatus should comply with **A.8.6**.

5.3.1 The transverse conversion loss shall be not less than 46 dB at any frequency in the range 300 Hz to 3 400 Hz.

Compliance shall be checked by the method described in Appendix E.

5.3.2 The power level of individual spectral components of any longitudinal component of the output signal shall not exceed – 59 dBm at frequencies from 200 Hz to 15 kHz, and – 70 dBm at frequencies from 28 kHz to 10 MHz. At frequencies between 15 kHz and 28 kHz, the power level shall not exceed a value determined by logarithmic interpolation of the frequency between – 59 dBm at 15 kHz and – 70 dBm at 28 kHz (see Figure 3). Apparatus with variable power levels shall have the one-minute mean power level set to – 13 dBm, or the maximum if less than – 13 dBm.

Compliance shall be checked by the method described in Appendix F.

NOTE The requirement to test up to 10 MHz is under consideration.

5.4 Signal power levels

5.4.1 For apparatus with a fixed power level, the maximum one-minute mean power level of all electrical signals, other than signals specified in **5.4.2**, shall not exceed -13 dBm.

Compliance shall be checked by measurement in accordance with items a) and e) of Appendix H.

For apparatus with variable power levels either:

- a) it shall not be possible for the maximum one-minute mean power level to exceed -13 dBm; or
- b) the means of adjustment:
 - 1) shall not be accessible to the user of the apparatus without the use of tools, or
 - 2) shall be rendered inaccessible or non-operative by physical guards that can only be released by the use of tools; or
 - 3) shall be operable only after the release of software locks requiring skills and detailed knowledge that are not made available to the user of the apparatus.

Compliance shall be checked for alternative a) by measurement of the maximum one-minute mean power level, such measurement being made in accordance with item a) of Appendix H, at maximum, minimum and one other setting of a user-controlled adjustment or by inspection for alternative b).

NOTE Out-of-band noise is under consideration.

5.4.2 For apparatus sending speech or music signals, the following requirements apply.

- a) Under any normal operating mode [see **9.3 j**], speech signals such as those originating from a microphone or radio receiver shall have a mean power level whilst active not exceeding -11 dBm.

Compliance shall be checked by measurements in accordance with items a) and e) of Appendix H except that the averaging shall be completed over the period of the active speech signal, or one minute, whichever is the shorter period.

Alternatively, compliance can be checked with a peak programme meter complying with BS 5428-9:1981 when the peak power level shall not exceed 0 dBm.

Under any normal operating mode [see **9.3 j**] music signals shall have a mean power level whilst active not exceeding -14 dBm.

Compliance shall be checked by measurement in accordance with items a) and e) of Appendix H except that the averaging shall be completed over the period of the active music signal, or one minute, whichever is the shorter period.

Alternatively, compliance can be checked with a peak programme meter complying with BS 5428-9:1981 when the peak power level shall not exceed -3 dBm.

NOTE Users are reminded that the performance of British Telecommunications plc speechband circuits will accord with Appendix A. There is no guarantee of performance in respect of dynamic range.

- b) Any telephone to be directly connected to a speechband circuit or connected to or comprised in a relevant branch system for speech band circuits shall comply with either **4.11 b)** or **4.11 d)**; or shall comply with **13.1 a)** of BS 6317:1982 at 0 km only and upper limit A, **13.3.1** of BS 6317:1982 at 0 km only and upper limit only, and **13.10** of BS 6317:1982.

5.4.3 Except for apparatus specified in **5.4.2 b)**, the total power level in a 10 Hz bandwidth contained wholly within the frequency band 0 Hz to $3\,400$ Hz shall not exceed -33 dBm up to frequencies of 100 Hz, -23 dBm at frequencies from 100 Hz to 200 Hz, -10 dBm at frequencies from 200 Hz to $3\,200$ Hz, and -23 dBm at frequencies above $3\,200$ Hz (see Figure 4). Apparatus with variable power levels shall have the one-minute mean power level set to -13 dBm, or the maximum if less than -13 dBm.

Compliance shall be checked by measurement in accordance with items b) and e) of Appendix H.

5.4.4 Except for apparatus specified in **5.4.2 b)**, the maximum instantaneous power level over the frequency range 200 Hz to $3\,400$ Hz shall not exceed that of a sinusoidal signal with a power level of 0 dBm. Apparatus with variable power levels shall have the one-minute mean power level set to -13 dBm, or the maximum if less than -13 dBm.

Compliance shall be checked by measurement in accordance with items c) and e) of Appendix H.

5.4.5 The power level of individual spectral components of the output signal shall not exceed -33 dBm at a frequency of 3.4 kHz, and -40 dBm between 5.1 kHz and 8.9 kHz. Between 3.4 kHz and 5.1 kHz, the power level shall not exceed a value determined by logarithmic interpolation of frequency between -33 dBm at 3.4 kHz and -40 dBm at 5.1 kHz. Between 8.9 kHz and 50 kHz, the power level shall not exceed a value obtained by logarithmic interpolation of frequency between -40 dBm at 8.9 kHz and -70 dBm at 50 kHz. Between 50 kHz and 10 MHz, the power level shall not exceed -70 dBm (see Figure 5). Apparatus with variable power levels shall have the one-minute mean power level set to -13 dBm, or the maximum if less than -13 dBm.

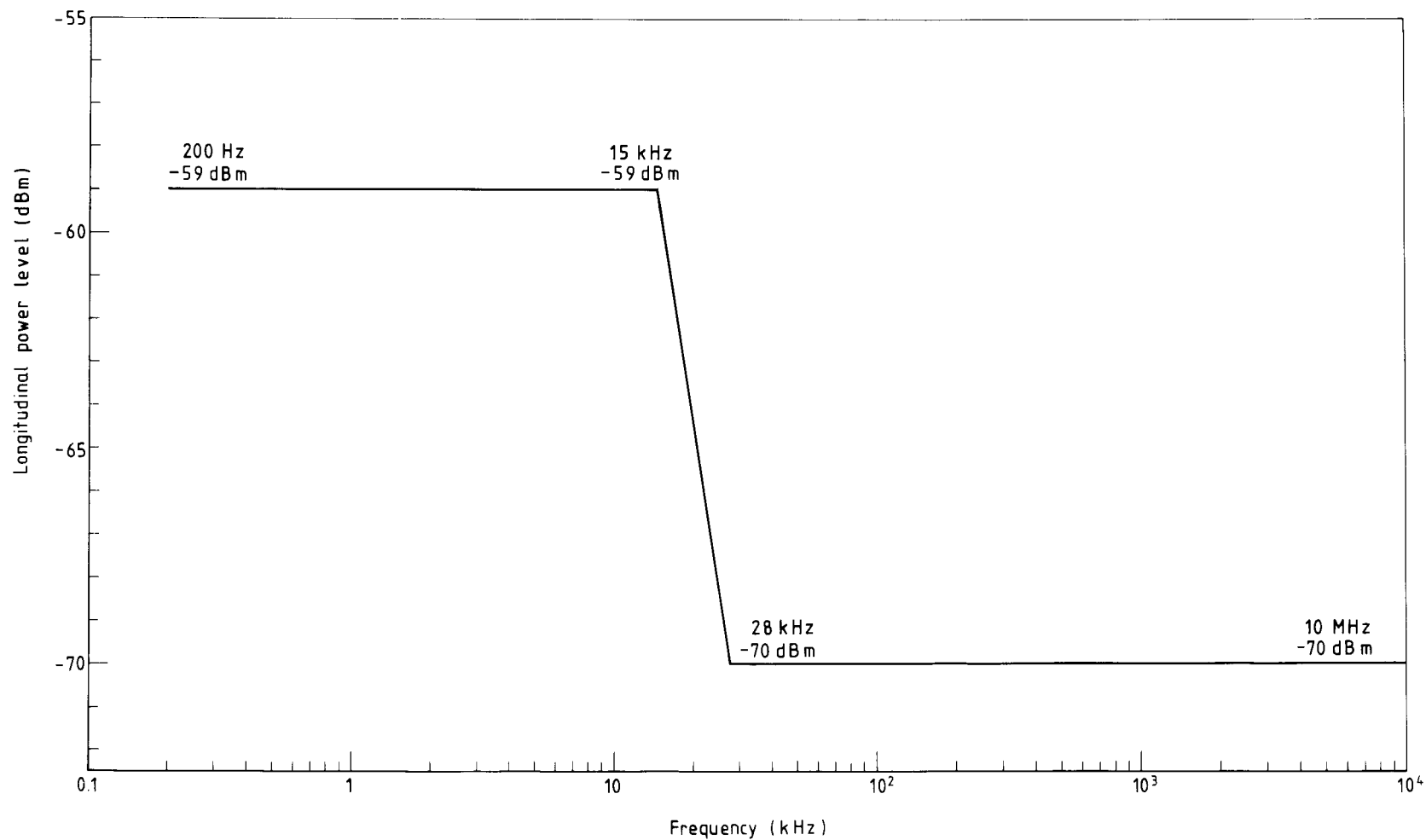


Figure 3 — Longitudinal power level limits as a function of frequency

